Hubble Space Telescope:
Comet ISON Intact, October 2013

Hubble takes two 500-second images through two different filters. The stars smear in the background because the telescope is aimed on moving comet. The bright speckles, different in each frame, are from random cosmic ray strikes on the detector. The black bar is from the camera's chip. Note the shift of background star trails in the time between exposures.

Combine the two exposures. In shifting the scope slightly ("dithering"), defects like the black bar appear in different parts of the image, so they can be mapped and removed.

← Software combines the images and cleans out some of the artifacts. Only two exposures, so you can't reject all artifacts in the gap.

Only one orbit and two filters. Apply a next step to get rid of some residuals, like cosmic rays...to get the actual clean comet image. Some subtle artifacts remain, but are known.

Note: More images allow you to build up signal. Enhance comet and you enhance noise. Signal adds up with number of images taken, but the noise goes up only with the square root of the number of images taken.

To bring out comet details, you can apply false colors that exaggerate features. In this clean image you can still see faint residual artifacts
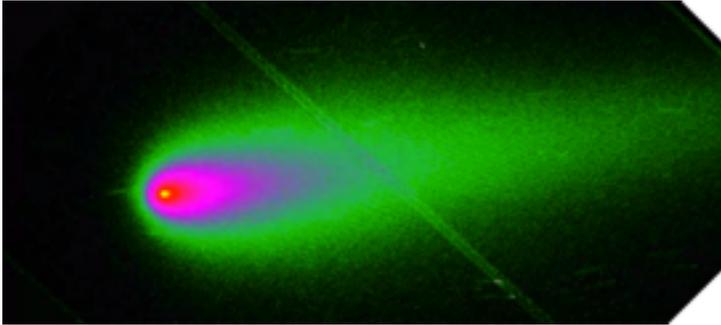
To find anomalies, tweak a little more. Basically, make a computer model of what a simple comet *should* look like without all the crud, then subtract the model out so all that remains are anomalies. No anomalies (like the jet seen in April)
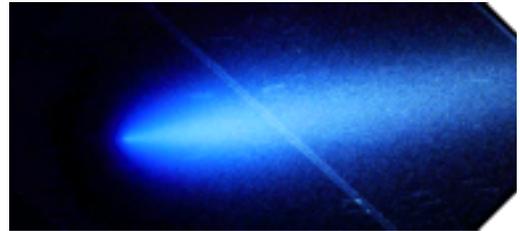
Finally, reapply color to the individual images taken through filters to get final color composite.

The News:
Comet Intact; No Jet.

The result is a beautiful image that shows true colors as seen through two filters.

Narrow range of colors. The comet is not strongly colored. The coma, as expected, is more blue green, and the tail a bit redder with the two-filter image. A third filter used by other astronomy imagers would yield a greener image. The color, shifted to blue with Hubble, is real.

Color caused by gas in coma and size of dust particles.

See the Hubble Space Telescope Hangout on Google+ at
https://plus.google.com/u/0/+hubblespacetelescope/posts